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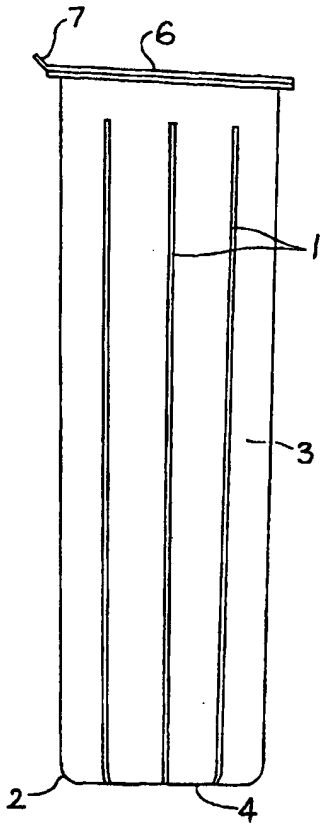
(54) Title: SELF-STANDING FLEXIBLE BAG

(57) Abstract

A flexible, self-supporting shaped plastics bag has an open end surrounded by a rigid flange, a tubular or frusto-conical side wall depending from the flange to form a generally tubular portion and a base joining the side wall through a radiused portion, the side wall being provided with a plurality of reinforcing ribs extending longitudinally along the tubular portion and through the radiused portion. The thickness of the ribs increases progressively from the open end portion of the container through the radiused portion at which the ribs form elongated knuckles reinforcing the junction of the side wall and base and enabling the container to stand on its base.



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SELF-STANDING FLEXIBLE BAG

This invention relates to lightweight, flexible plastic bags or pouches and in particular relates to such bags usable as containers for liquid foods or food pastes, and other liquids such as motor oil or household solvents and cleaners.

Much of the recent development in this product area has been in relation to self-standing pouches and disposable infant feeding bottles such as described below. However, a common and important difficulty is in providing such flexible containers which are collapsible to minimise shipping volume and waste volume, yet self-supporting when both empty and full. Another difficulty is with filling such a non-rigid container. Both of these difficulties are addressed in the present invention. The invention also addresses the trend to minimising the use of difficult to recycle materials in such containers, that is by minimising wall thicknesses, whilst retaining adequate functionality. Ideally such containers should be self-supporting for filling, stable during use, yet easily collapsed when emptied by the user.

To illustrate some of the background to this invention, we further consider the "baby bottle" marketed in the U.S.A. by the Playtex company. This consists of an open ended rigid plastic tube together with a screw-top and rubber teat, and is supplied with a number of empty collapsed, flat plastic bags. In use, one such bag is loaded into the open tube and filled with infant formula. The rubber teat and screw-top are then screwed down onto the open end of the plastic bag. The infant can then drink some or all of the contents held within the bag, which collapses as it is emptied. This minimises or eliminates the problem of "air-sucking" during drinking by the infant and provides a more natural, consistent flow of liquid.

When empty, the collapsed bag is then disposed of and no bottle washing is required. Many parents prefer this, as bottle washing with detergent causes concern

about residual chemicals from the detergent dissolving into the formula and being consumed. Nevertheless, the flat empty bags have no flange or flat base and are quite difficult to fit into the holder without leaking. They can be messy to fill and do not lend themselves to refrigeration storage without leaking when pre-filled from a larger batch of formula.

More recently E.I. Du Pont De Nemours & Company in their International Patent Application No. PCT/US90/02367 described an alternative baby bottle construction. The main difference compared with the Playtex bottle was the provision of a semi-rigid, cup-shaped disposable container which replaces the flat plastic bag of the Playtex design. This disposable container is provided with a rigid annular flange at the mouth of the container and thin side walls which are progressively collapsible and which vary in thickness going from very thin near the base to thicker near the flange.

The Du Pont container construction has the advantage that it can be more easily placed in an outer rigid tube because of its rigidity compared with the floppy bag of Playtex. The flanged rim gives a further advantage by providing a stable surface onto which the teat can be sealed. Also, because it retains its shape when filled with product, it is more suitable for marketing in pre-filled form than a non-rigid bag. Furthermore, the rigid flange at the rim is suitable for heat sealing with removable foil or film making the package more user friendly and attractive to consumers.

Whilst the Du Pont container has a number of advantages over simple bags, it has aspects which can cause difficulties. For example, the progressive change in wall thickness can be difficult to control accurately in the container manufacturing process. Furthermore, the region where the thin side walls of the container meet the base may be relatively weak and prone to crumpling. This may be overcome by increasing the thickness of the base, but there is the consequent disadvantage that more plastic material must be used to produce the container.

It is an object of the invention to provide a container consisting of a flexible yet self-supporting bag-like tube which reduces or ameliorates one or more of the aforesaid disadvantages.

In one aspect the invention provides a flexible, self-supporting shaped plastics bag having an open end surrounded by a rigid flange, a tubular or frusto-conical side wall depending from the flange to form a generally tubular portion and a base joining the side wall through a radiused portion, the side walls being provided with a plurality of reinforcing ribs extending longitudinally along the tubular portion and through the radiused portion, characterised in that the thickness of said ribs increases progressively from the open end portion of the container through the radiused portion at which the ribs form elongated knuckles reinforcing the junction of the side wall and the base and enabling the container to stand on its base.

The container according to the invention may be used for packaging a range of products including food pastes such as vegetable or fruit puree or potable liquids such as orange juice or milk or other materials such as oil or water, as well as non-food liquid products such as lubricating oils, shampoos and household chemicals.

The container may be formed from a mono- or multi-layer sheet of plastics material by a cuspation dilation method along the lines of that described in Australian Patent No. 534392. If the container is formed generally according to this method, it may be formed with the aforesaid reinforcing ribs running longitudinally along the tubular wall. We have found a way to extend these ribs into the radiused portion joining the wall to the base and this new property forms an important part of our invention, as described hereinafter.

The cuspation dilation method described in Australian Patent No. 534392 involved stretch-forming a hollow article from a heated sheet of thermoplastics material and comprised pressing against one face of the sheet in a primary movement a plurality of tips carried

symmetrically by a tool at a temperature lower than 50°C below the melting point of the sheet and comprising a plunger having an axis extending in the direction of the primary movement, each tip being constituted by an end of a blade which blade is coplanar with the plunger axis and pivoted to the plunger, and, while continuing the primary movement, rotating the blades about their pivots while maintaining each blade coplanar with the plunger axis to symmetrically separate the tips in directions transverse of the plunger and to bring the outer edge of each blade from the tip progressively towards the rear into engagement with the sheet.

When the preferred cuspation dilation (CD) process is used to produce the present pouch-like containers, the resultant ribs naturally taper in thickness, being almost non-existent at the open end, then progressively thickening to the base and corner knuckle. This is a very desirable property for a deep tube of greater than 2.5 draw ratio, as the accumulated vertical buckling load on the wall increases towards the bottom of a filled, standing pouch.

The thick knuckles which reinforce the base-side wall junction are new, and not seen in earlier CD products. They are formed by changing the CD blade tip geometry away from a relatively sharp tip, that is a tip which chills a localised "blob" of thermoformed melt of plastics material, to a radiused tip, which chills an extended thick knuckle around the side wall corner and into the base at each rib location.

It was previously considered undesirable to use other than a sharp blade tip, as this was thought then to allow "sledging" of the material over the blade end, causing an uncontrolled thinning of the base during draw down of the melt. This was seen to be caused by the relatively strong "cable" of cooler ribbed material chilled by each blade becoming strong enough to pull still molten material around the blade tip from the base. The sharp blade tip was found normally to anchor the melt material and prevent this. However, it is has now been

found possible, for example by the use of more flexible plastics materials, together with the very thin walls required for the present products, for an extended knuckle to be formed without sledging occurring.

The material of the container may be a plastics material which is a single or multiple-layer material which may be resistant to oxygen permeation. A multi-layer plastics material comprising a composite of different layers of different plastics with desired properties is particularly suitable. A softer polypropylene, ethylene vinyl alcohol, polypropylene copolymer composite may be suitable in such applications. Other preferred materials leading to good flexibility in the formed products of the present invention include low density polyethylene, linear low density polyethylene, thermoplastic polyurethane and plasticised polyvinyl chloride.

The container of the invention is also provided with regions of different thickness to allow the container to progressively collapse under pressure differential, for example arising from squeezing the side wall or applying suction to remove the contents, but designed to allow the container to also be free-standing and to maintain its shape (whether or not it is filled with product) in the absence of pressure differential. Preferably the side wall have a film thickness in the range of 30 to 300 micrometers and the ribs have an average thickness in the range of 80 to 600 micrometers and are spaced between 0.5 and 1.5 centimeters apart.

Preferably, the longitudinal ribs will be of the order of 1.5 to 4 times the thickness of the tubular wall film of the container. Typically rib thickness will be 150 micrometers to 300 micrometers and the wall film thickness may be substantially constant, and preferably in the range of 50 micrometers to 150 micrometers. The ribs may typically have a width in the range 1mm to 2mm.

The base of the container may generally have a thickness in the range 50 micrometers to 500 micrometers.

The length of the container formed in accordance

with the present invention is preferably greater than 2.5 times the maximum transverse dimension of the open end. Thus for a cylindrical container of 50cm diameter, the length will preferably be at least 125cm.

The thickness of the flange will generally be greater than that of the body of the container. Depending on the physical properties of the plastics used, the thickness of the flange will be chosen to ensure a degree of rigidity thereof. In most instances, a thickness in the range of 500 micrometers to 1000 micrometers will be required for the flange.

Measurement of the suction achievable by a small baby suggests that the container when used as a baby bottle should be capable of collapsing when suction creating a differential container/atmosphere pressure of 1 kPa is applied through the teat.

Rigidity against bending/buckling during tilting to pour or drink, is also important. This tendency to bend and/or buckle is worst when the tube is partially empty. The weight of the remaining liquid is concentrated in the lower part of the container and this tends, on further tilting, to collapse the already empty part of the tube nearer to the open end, below the hand. The longitudinal ribs in the containers of the present invention thus play an important role in reducing this tendency, hence less material can be used in this tubular pouch. This in turn reduces the amount of rubbish generated from discarded packaging.

The integral flange, unique for a plastic bag, provides a means of attaching a sealed (for example, heat-sealed film or foil) closure, to maintain a hermetic, bacteria tight package and enabling convenient re-opening. The integral flange also provides a means of reliably clamping the bag into a wide range of dispensers, for example baby bottle holders, without risk of leakage.

This invention is further described with reference to the attached drawings wherein:-

Figure 1 shows a filled container;

Figure 2 shows an enlarged sectional view of a circled

section of the container of Figure 1;

Figure 3 shows a container with a seal and dispensing flange;

Figure 4 shows a container of rectangular cross section;

Figure 5 shows a plurality of filled containers in an overpackage; and

Figures 1 and 2 illustrate a self-supporting collapsible container and show it in a filled condition containing nutritional, non-carbonated contents (15) and sealed with a foil (6) of metal or plastic which is to be highly resistant to oxygen permeation attached by a peelable, heat, radio-frequency, ultrasonic or friction weld (5) to the relatively thick (say 1mm thick) ring flange (9) to (13) of the hollow container. The container has longitudinally extending ribs 1 formed in the side wall of its tubular portion 3 and extending into radiused portion 2 where the side wall merges with base 4. Ribs 1 are relatively thick compared with the thickness of the side wall between them and form knuckles around the radiused portion 2 which enable the container to stand without independent support, whether filled or unfilled.

Items (9) to (13) are an out-of-scale cross section of the multi-layer material which also makes up the relatively very thin walls and base (typically of say 50 to 200 micrometers total thickness) of the container. These layers, bonded together, typically comprise an inner layer (13) of clean, heat resistant, moisture containing thermoplastic polymer, such as polypropylene or polyethylene, two thin adhesive layers (11) on each side of an oxygen barrier layer (12) which is made of a so-called high oxygen barrier thermoplastic polymer such as ethylene vinyl alcohol or polyvinylidene chloride, or other "oxygen barrier" thermoplastics, a scrap layer (10), containing recycled thermoplastic material and an optional outer layer (9) which may be pigmented for colour or opacity to light (as may any or all of the other aforesaid layers).

The container shown in Figure 3 incorporates the ribbing, knuckles and thin film features disclosed in

relation to the containers at Figures 1 and 2. However it is also provided with an optionally thicker walled member 51 shaped in the form of a pouring spout, with a step 52 providing a flange 53. The flange stiffens the container, provides a more rigid means of gripping it in the hand after it is opened and also provides a sealing area for attachment of a sealing film 54 applied over the mouth of the container. The film may be heat sealed to the flange and may incorporate means to facilitate removal such as the pull tab 55.

In Figure 4 a container of square cross section 15 is illustrated to show that the invention is equally applicable to containers having a range of shapes. From this illustration it can be seen that the longitudinal ribs 61 extend into a radiused portion 62 joining the base of the container to the tubular portion 63. The ribs form knuckles at the radiused portion as detailed above in relation to Figures 1 and 2.

Referring to Figure 5, a number of filled and sealed containers 71 according to the invention are shown in a multiple overpack 72. The overpack includes a number of openings top and bottom and designated 73 and 74 respectively to snugly receive the containers 71 in the manner illustrated. The flanges 75 of the containers serve to locate them in the overpack. An outer rigid or semi-rigid cover or stretch film envelope 76 may optionally be provided for additional light blocking or dust protection.

The containers of the invention can be sold empty, as a disposable pouch, such as for disposable baby bottles to be fitted into rigid holders. For this use no oxygen barrier would be needed. If sold as a filled and sealed pack, for chilled storage and distribution, a polymer oxygen barrier layer would also then not be required.

If a polymer layer for oxygen barrier is incorporated into the walls of the tube and if the pack is then sterilised and aseptically filled with suitable heat treated food, or filled first without sterility and then heat or radiation treated as a sealed pack, then a shelf

stable packed product will result, which will not need chilled distribution or refrigerator storage.

If filled with liquid or semi-solid food, it may be desirable to pack with a small inert gas overpressure, typically less than 0.1 atmosphere, in order to provide internal support from both the contents and gas pressure, for handling and transportation of the filled packs. Optionally, overpacking of the type shown in Figure 5, could also be adopted, to help to ensure that the packages reach the end user in good condition.

CLAIMS:

1. A flexible, self-supporting shaped plastics bag having an open end surrounded by a rigid flange, a tubular or frusto-conical side wall depending from the flange to form a generally tubular portion and a base joining the side wall through a radiused portion, the side wall being provided with a plurality of reinforcing ribs extending longitudinally along the tubular portion and through the radiused portion, characterised in that the thickness of said ribs increases progressively from the open end portion of the container through the radiused portion at which the ribs form elongated knuckles reinforcing the junction of the side wall and base and enabling the container to stand on its base.

2. A container as claimed in claim 1, characterised in that the side wall has a wall thickness in the range of 30 to 300 micrometers and the ribs have a thickness in the range of 80 to 600 micrometers and are spaced between 0.5 and 1.5cm apart.

3. A container as claimed in claim 1 or claim 2, characterised in that the ribs have a thickness 1.5 to 4 times the thickness of the side wall.

4. A container as claimed in any preceding claim, characterised in that the side wall has a wall thickness in the range of 50 to 150 micrometers and the ribs have a thickness in the range of 150 to 300 micrometers.

5. A container as claimed in any preceding claim, characterised in that the length of the container is greater than 2.5 times the maximum transverse dimension of the open end.

6. A container as claimed in any preceding claim, characterised in that the base has a thickness in the range of 50 to 500 micrometers.

7. A container as claimed in any preceding claim, characterised in that the ribs have a width in the range of 1 to 2 millimeters.

8. A container as claimed in any preceding claim, characterised in that the flange has a thickness in the range of 500 to 1000 micrometers.

9. A container as claimed in any preceding claim characterised in that the container is progressively collapsible under a differential pressure between the interior and exterior of the container of 1 kPa.

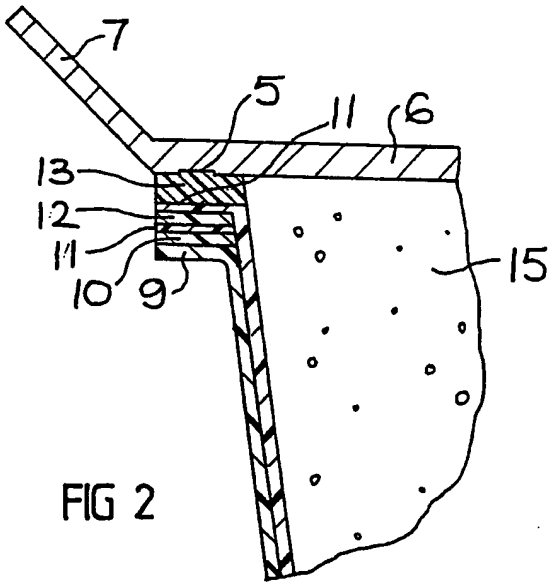

FIG 2

FIG. 2

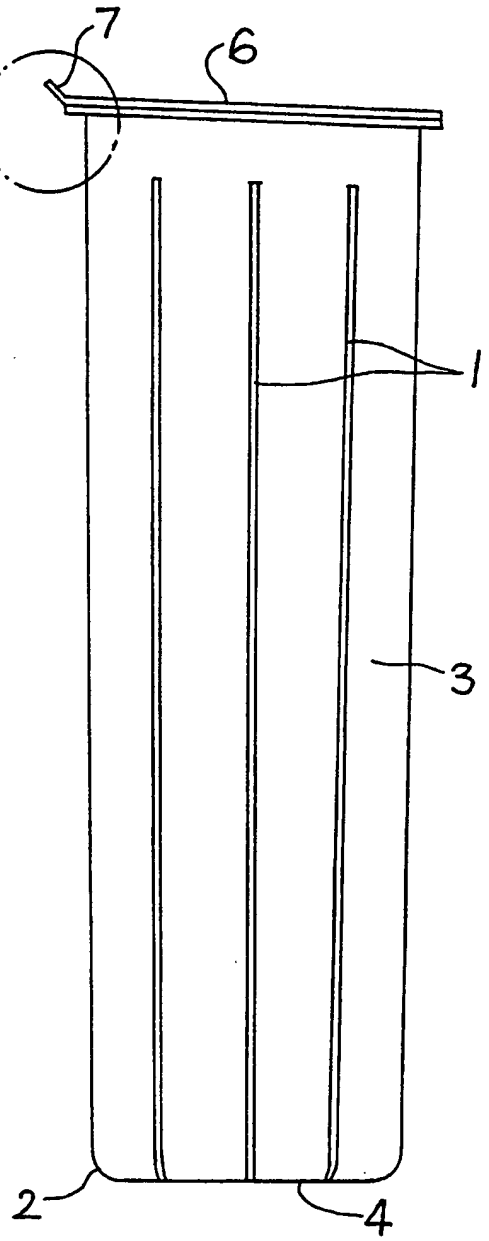

FIG 1

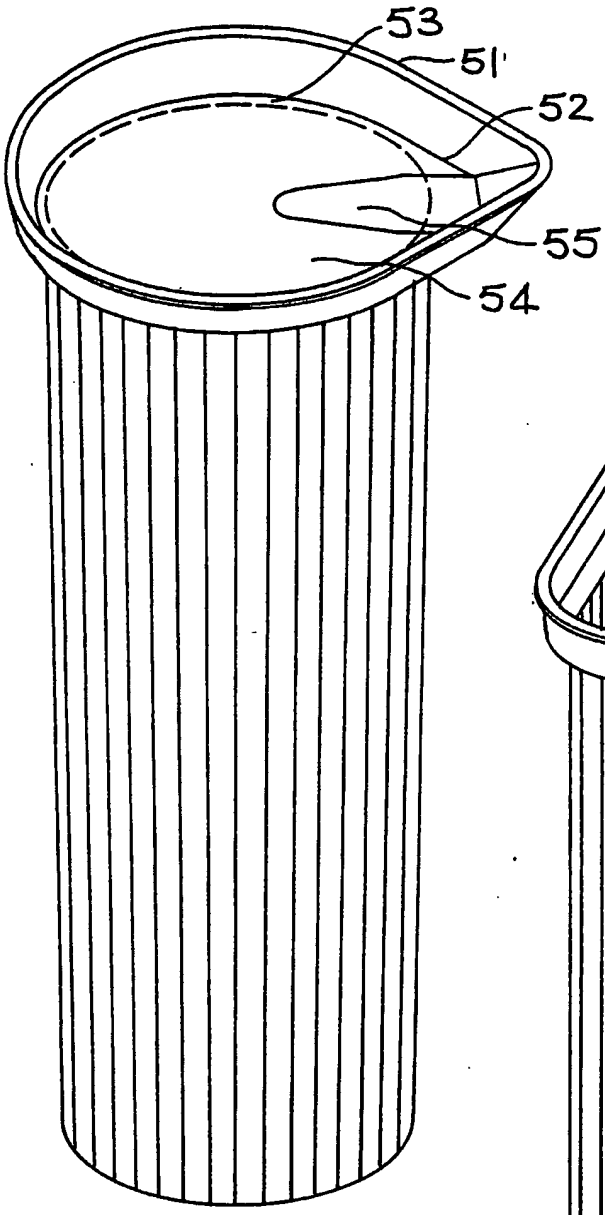

FIG 3

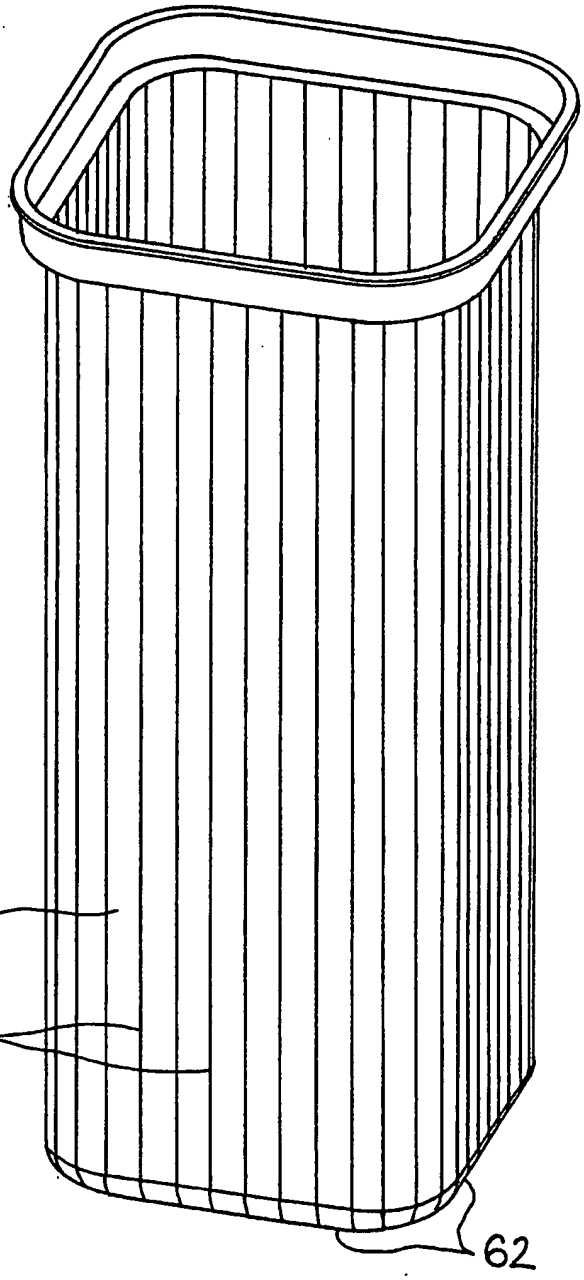

FIG 4

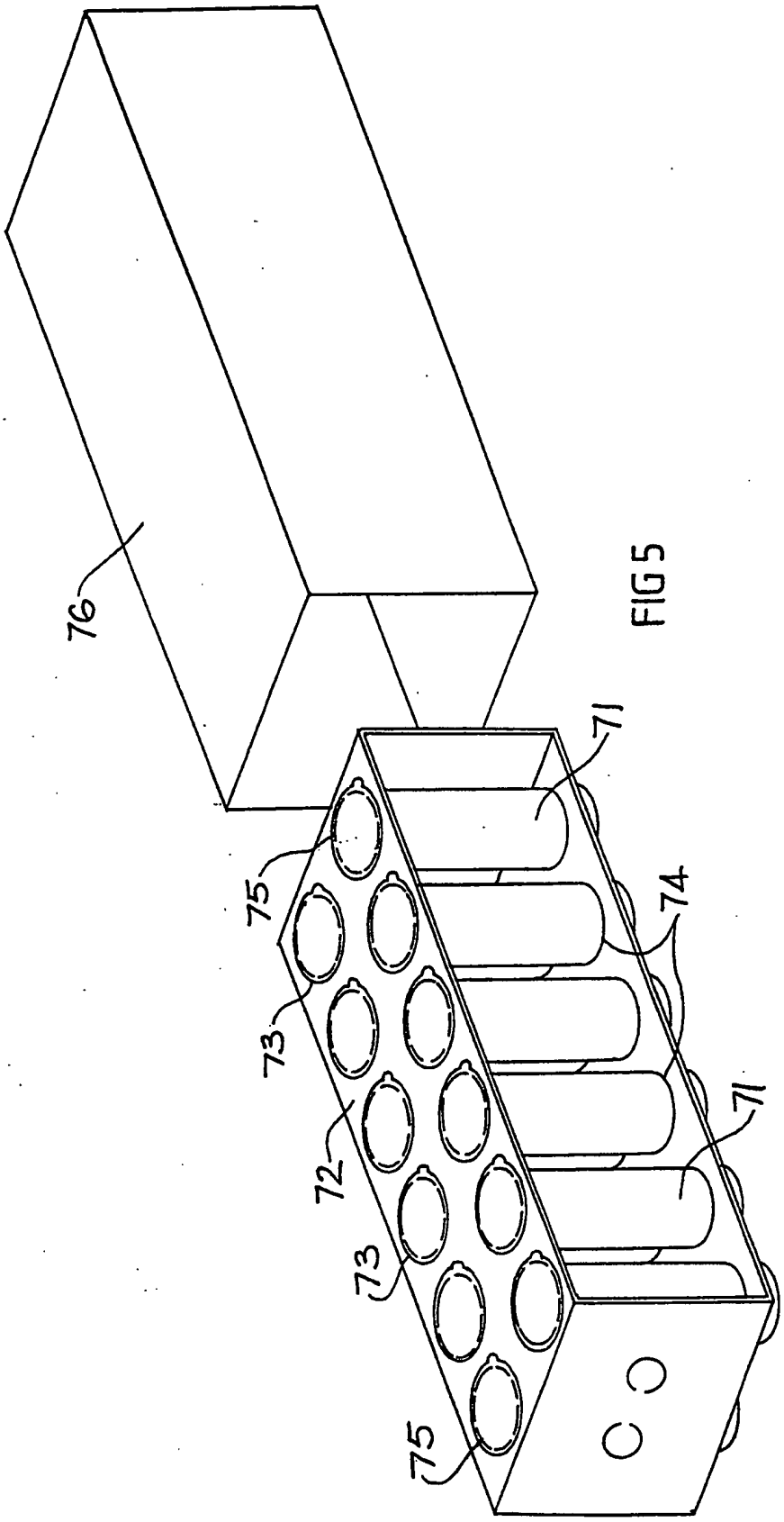

FIG 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 94/00638

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl.[6] B65D 30/16, 33/02 // A61J 9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: B65D 1/26, 1/32, 1/42, 30/10, 30/16, 33/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above and B65D 25/16; A61J 9/00

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	AU,A, 42945/93 (ACI OPERATIONS PTY LTD) 9 December 1993 (09.12.93)	
P,X	Figure 2	1-9
Y	Ribs of increasing thickness (radial direction)	1-9
	AU,B, 47160/79 (534392) (AARC (MANAGEMENT) PTY LIMITED et al.) 1 May 1980 (01.05.80)	
X	Figure 1 Page 4d	1-9
Y	Ribs of increasing thickness (radial direction)	1-9

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
4 January 1995 (04.01.95)	10 Jan 1995 (10.1.95)
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No. 06 2853929	Authorized officer R.J. KIRBY Telephone No. (06) 2832569

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	AU,B, 32558/50 (147608) (THE METAL BOX COMPANY) 20 April 1950 (20.04.50) Figures 1, 2, 5. Ribs (beads) 10	1
Y	AU,A, 81441/82 (AARC (MANAGEMENT) PTY LIMITED) 2 September 1982 (02.09.82) Figure 1	1-9
A	AU,B, 30878/63 (265114) (ILLINOIS TOOL WORKS INC) 26 November 1964 (26.11.64) Figures 11, 12, 13	
A	Patent Abstracts of Japan, M1410 Page 154, JP,A, 4-367434 (MAMORU KAMO) 18 December 1992 (18.12.92) Abstract	

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
AU	42945/93	WO	9324391				
AU	47160/79	AT	10457	CA	1135020	DE	2967310
		DK	2053/79	DK	159910	EP	6682
		HK	493/88	IE	49576	NO	791654
		NO	160912	NZ	190442	SG	1019/87
		US	4288401	US	4480979	JP	55007486
		JP	3075337	AU	81441/82	BE	892233
		EP	72832	GR	76068	IL	65231
		PT	74483	WO	8202850	IT	8219802
		ZA	8201179	IT	1235456	IT	8219802
AU	81441/82	US	4480979	BE	892233	EP	72832
		GR	76068	IL	65231	IT	8219802
		PT	74483	WO	8202850	ZA	8201179
		AT	10457	AU	534392	CA	1135020
		DE	2967310				
JP	4367434						

END OF ANNEX